

**WHAT IS CLAIMED IS:**

1. A process of forming metal interconnects, comprising:
  - forming a first opening in a first dielectric layer;
  - filling a first metal layer in the first opening;
- 5 forming a first film layer over the first dielectric layer and the first metal layer;
  - performing a thermal process to induce a reaction between the first metal layer and the first film layer to form a first protective layer on the surface of the first metal layer; and
  - removing an unreacted portion of the first film layer.

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2. The process according to claim 1, wherein the first metal layer is comprised of copper.

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3. The process according to claim 1, wherein the first film layer is comprised of a conductive material or a non-conductive material.

4. The process according to claim 3, wherein the conductive material is selected from a group consisting of stannum (Sn), aluminum (Al), and stannum-lead alloy (Sn-Pb).

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5. The process according to claim 1, wherein the first film layer has a thickness of between 10 Å ~ 500 Å.

6. The process according to claim 1, wherein the thermal process is performed at a temperature lower than 400 °C.

7. The process according to claim 1, further comprising a step of forming a 5 first stop layer on the surface of the first dielectric layer before the step of forming the first opening in the first dielectric layer.

8. The process according to claim 1, after the step of removing unreacted portion of the first film layer, further comprising:

10 forming a second dielectric layer over the first dielectric layer to cover the first protective layer;

forming a second opening in the second dielectric layer to cut through the first protective layer and expose the first metal layer;

15 filling a second metal layer in the second opening to electrically contact the first metal layer;

forming a second film layer over the second dielectric layer and the second metal layer;

20 performing a thermal process to induce a reaction between the second metal layer and the second film layer to form a second protective layer on the surface of the second metal layer; and

removing an unreacted portion of the second film layer.

9. The process according to claim 8, wherein the second metal layer is comprised of copper.

10. The process according to claim 8, wherein the second film layer is comprised of a conductive material or a non-conductive material.

11. The process according to claim 10, wherein the conductive material is  
5 selected from a group consisting of stannum (Sn), aluminum (Al), and stannum-lead alloy (Sn-Pb).

12. The process according to claim 8, wherein the second film layer has a thickness of between 10 Å ~ 500 Å.

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13. The process according to claim 8, wherein the thermal process is performed at a temperature lower than 400 °C.

14. The process according to claim 8, further comprising a step of forming a  
15 second stop layer on the surface of the second dielectric layer before forming the second opening in the second dielectric layer.

15. A structure of metal interconnects, comprising:  
a first dielectric layer, having a first opening therein;  
20 a first metal layer, formed in the first opening; and  
a first protective layer, formed on the surface of the first metal layer not covered by the first dielectric layer.

16. The structure according to claim 15, wherein the first metal layer is comprised of copper.

17. The structure according to claim 15, further comprising a first stop layer on 5 the surface of the first dielectric layer with the first opening formed in the first dielectric layer and the first stop layer.

18. The structure according to claim 15, further comprising:  
a second dielectric layer, formed over the first dielectric layer, wherein the  
10 second dielectric layer has a second opening therein cutting through the first protective  
layer to expose the first metal layer;  
a second metal layer, being filled into the second opening; and  
a second protective layer, formed on the surface of the second metal layer not  
covered by the second dielectric layer.

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19. The structure according to claim 18, wherein the second metal layer is comprised of copper.

20. The structure according to claim 18, further comprising a second stop layer  
20 on the surface of the second dielectric layer, wherein the second opening is formed in  
the second dielectric layer and the second stop layer.